significantly more windings than said lower coil and significantly greater size comprising the steps:

shielding said upper coil from ambient magnetic field fluctuations not caused by vibrations of said strings, and diverting said ambient magnetic field fluctuations so as to be concentrated in said core ~~the vicinity~~ of said lower coil;

concentrating magnetic field fluctuations caused by vibrations of said strings (string flux) in said upper coil and shielding said lower coil from said string flux; and

subtracting the signal generated in said lower coil from the signal generated in said upper coil.

REMARKS

Claims 9, 12 and 13 were objected to as referring to withdrawn claims. In response, these claims have been rewritten in independent form to incorporate the limitations of there parent claims.

Claim 3 was rejected as indefinite. In response, the reference to the prior art was removed and limitations describing the structure were substituted.

Claims 1, 3, 9, 17 and 18 have been rejected as anticipated under 35 USC 102 by US 5,811,710 (Blucher). In response to this rejection, claim 1 has been amended to specify that the lower coil is significantly smaller and has fewer windings than the upper winding, and to specify that the flux transfer plate means injects noise flux directly into the core of the lower coil. There is no teaching in Blucher that the lower coil is significantly smaller and has fewer windings than the upper coil. In fact, the drawings of Blucher at Figures 2 and 4 show the upper coil and lower coil to be the same size.

The advantage of having the upper coil in the claimed invention be larger is that it can

have significantly more turns which allows it to pick up significantly more string signal. Its larger size causes the upper coil in the invention to also pick up more unwanted hum signal. This hum signal is eliminated or reduced by the fact that the smaller lower coil has its efficiency in picking up hum signal increased by the flux transfer plates which guide flux variations constituting unwanted hum into the very core of the lower coil which is the most efficient place to inject the hum signal. This cause the smaller size lower coil to still cancel all or most of the hum in the larger upper coil while still being smaller in size. The smaller size lower coil allows the combination structure to still be small which is advantageous because it can frequently fit into the cavities of older guitars with single coil pickups.

In addition, the flux transfer plate means in claim 1 is stated in means plus function form. That means that it must be interpreted in accordance with the teachings in the specification of structure which perform the stated function of diverting magnetic flux in an ambient magnetic field away from the upper coil means and into a core of the lower coil means. The specification and drawings show the flux transfer plate means 26 in Figure 3 to form a continuous, uninterrupted path from a place adjacent the side walls of the upper coil where noise flux headed for the upper coil is intercepted. This noise flux is diverted down into the core of the lower coil by the continuous, interrupted material of the flux transfer plate which represents the path of least resistance for the magnetic flux as opposed to air. There are no air gaps in this path. Air gaps, even the smallest of ones, are very lossy where magnetic flux transfer is concerned. The continuous flux transfer plates represent a high efficiency flux transfer mechanism to transfer the noise flux into the heart of the lower coil, and this high efficiency allows use of the asymetrical coil geometry. Without these high efficiency flux transfer plates, with the smaller lower coil, there would be insufficient noise signal induced in the lower coil to cancel out the

noise signal in the upper coil.

The Blucher prior art pickup would not function properly if its lower coil were significantly smaller than the upper coil because it lacks the high efficieny flux transfer plates. It would therefore have insufficient noise signal in the lower coil to cancel out noise in the upper coil.

The Blucher prior art pickup also does not teach an air gap between the magnetic pole pieces of the upper coil and the permeable core of the lower coil as is present in the invention of claim 1. The air gap being referred to here is air gap 46 in Figure 5. This air gap is part of the upper coil means. This air gap further isolates the lower coil from the upper coil so that less string signal gets picked up in the lower coil, which is a desirable trait since any string signal picked up in the lower coil cancels part of the desired string signal picked up in the upper coil.

Furthermore, Blucher does not teach a wrap around ferro-magnetic plate, only one with two vertical walls and which leaves the ends of the upper coil open and exposed to noise flux. In contrast, with reference to Figure 1, note how the flux transfer plates 24 and 26 (flux transfer means in claim 1) wrap around the ends of the upper coil to shield those ends from noise flux.

Furthermore, Blucher does not teach a lower coil form (10 in figure 1 - lower coil means in claim 1) which is made of ferrous material nor does anybody else. The claimed invention teaches that the lower coil form can be either ferrous or non ferrous in the following passage from page 7 of the specification.

> A lower coil form 10 serves as a bobbin around which a lower winding (not shown) is wound to form the lower coil. The lower coil form 10 has a slot 22 formed therein in which a ferrous blade 12 is inserted when the pickup is assembled. The lower coil form 10 can be made of injection molded plastic, glass reinforced nylon or any other non ferrous or ferrous material. The preferred material for the lower coil form 10 is glass reinforced nylon which is a form of injection molded plastic. The lower coil form 10 does not have to be

non ferrous, and it can be made of other ferrous materials such as ferrite, molded powered metal, a mix of polyurethane with iron filings or Metal Injection Molded steel. In one alternative embodiment discussed below, the bottom coil form 10 and flux transfer plate (24 and 26 in the embodiment of Figure 1) is formed of ferrous material so as to be all one piece.

Also in response to this rejection, claim 3 has been amended to specify that the lower coil has a significantly smaller winding cross-sectional area than the upper core, and to specify that the flux transfer plates inject noise flux into the core of the smaller lower coil.

Also in response to this rejection, claim 9, in addition to be amended to be in independent form has also been amended to eliminate the indefiniteness problem and further amended to specify a smaller lower coil than upper coil and flux transfer plates which inject noise flux directly into the core of the lower coil.

Claim 17 has been amended in response to the anticipation rejection to specify the upper coil as significantly larger than said lower coil and to specify that the flux transfer plates inject the noise flux into the core of the lower coil.

Claim 18 has been amended in response to this rejection so as to specify in the apparatus limitations of the preamble of this method claim that the upper coil has significantly greater size and number of windings than the lower coil and the flux transfer plate diverts noise flux into the core of the lower coil.

Claims 2, 4 and 16 were rejected as obvious over the combination of Blucher et al. in view of Stich (US 5,789,691).

A difference that this invention enjoys over the prior art two coil pickups is that the prior art two coil pickups have upper and lower coils of the same size whereas the claimed invention has an upper coil which is larger than the lower coil in that the cross sectional area of the windings of the upper coil is significantly larger (more turns) than the cross-sectional area of the windings of the lower coil. The reason this is significant

is that the larger upper winding allows the two coil pickup of the invention to pick up more string signal and have sonic characteristics which are very similar to the prior art single coils while still enjoying significantly reduced hum signal. The reduced hum signal is provided by the efficient injection of noise flux into the lower coil by the flux transfer plates. This more efficient injection of noise flux into the lower coil means better noise cancellation characteristics.

The Stich prior art patent does not teach a hum cancelling pickup. It is a single coil design which is wound continuously on two sections of the same bobbin. The sections of the bobbin are of unequal size with the intention of providing a "tapped" single coil design with two sections of radically different resonant frequencies. Both coils are fully engaged in the detection of the string signal which is exactly the opposite of the desired result in the claimed invention. Thus, one skilled in the art would be led away from the claimed combination by the teachings of Stich, and this is the antithesis of obviousness.

Additionally, Stich puts the smaller of the two coils on top which exactly the opposite of what the claimed invention. In the claimed invention, the inventor wants the smaller coil as far away from the strings as possible. Stich's reasoning is not applicable to the claimed invention, and Stich does not teach that he is trying to solve the problem of ambient noise reduction. Stich teaches in the abstract his purpose: "Substantially eliminate distortion and harsh sounding overtones by the reduction of mutual inductance..." In Col. 3, lines 17-35, Stich teaches his design goals, and none of them is about quiet operation or hum-cancellation.

The Examiner cites Stich for its teaching of a trim pot. However, the trim pot of the Stich invention is not used for the purpose of balancing or minimizing hum and noise, especially since his pickup is not hum-cancelling. The purpose of the trim pot, as stated in the Stich patent, is to "allow the player of the intrument to gradually adjust the

inductance and to reduce and shift the resonance peaks..." (col. 1, 12-15). Stich also teaches at Col. 9, lines 48-59 that the variable resistor is for the control of eddy currents.

Stich describes his inventions as "2 coils (or coil segments) which are in-phase with each other..." (Col. 9, 36-42). This is exactly the opposite of what the claimed invention does with the second lower coil which is wired to be out of phase with the first larger coil so as to cancel hum signal. This teaches away from the claimed combination and does not render it obvious.

If Stich and Blucher were to be combined, the two coil design of Blucher would be modified to have a smaller upper coil instead of the smaller lower coil of the claimed invention, and there would be no wrap around flux transfer plates that conduct noise into the now larger lower coil. The small upper coil would be picking up string signal, but the lower coil would also be picking up a large amount of the string signal due to its close proximity to the strings. The large string signal present in the lower coil, when combined in the aforementioned out of phase relationship with the upper coil, would tend to cancel a large percentage of the string signal in the upper coil, leaving a string signal with weak output. Further, if the Blucher shield plates were to be employed, shielding the small upper coil from noise flux, it would be virtually impossible to effectively cancel noise because of imbalanced contributions from the upper and lower coils. This entire arrangement is exactly the opposite of the teachings of the present invention. The combination of Stich and Blucher teach away from the claimed invention, not toward it.

These differences over the prior art are present in claim 2 because claim 2 depends from claim 1 and claim 1 has been amended to specify the lower coil means has a smaller size than the upper coil means. In addition, the flux transfer means of claim 1 has been amended to specify that the noise flux is guided into the core of the lower coil means.

Claim 4 depends from claim 3 which has been amended to specify that the lower coil

winding is significantly smaller in cross-sectional area than the upper coil winding and the flux transfer plate means functions to guide noise flux into the core of the lower coil. Further, claim 4 has been further amended to specify that the lower coil is not shielded from ambient noise flux whereas the upper and lower plates of the upper coil form have electrostatic, non ferrous shielding material thereon.

Claim 16 has been amended to specify that the lower coil form is substantially smaller than said upper coil form and the lower coil winding is substantially smaller in cross-sectional area and windings than the upper coil. The flux transfer plate limitation has also been amended to specify the noise flux is guided into the core of the lower coil.

The larger size of the upper coil also means the lower coil is further away from the strings so the lower coil picks up less string signal and therefore cancels less string signal. The smaller size of the lower coil also makes it less efficient in picking up string signal, or any signal for that matter. This is why the flux transfer plates are used to guide noise flux into the lower coil core.

The Blucher et al. reference (5,811,710) teaches upper and lower coils which are the same size. Further, there is no flux transfer plate which guides the noise flux into the core of the lower coil. Therefore, the Blucher et al. reference does not anticipate the now amended rejected claims 1, 3, 9, 17 and 18, and the combination of Blucher et al. with Stich does not render claims 2, 4 or 16 obvious.

Claim 10 has been voluntarily amended to remove an incorrect limitation regarding shielding the upper coil from the lower coil.

Claim 4 has been voluntarily amended to add electrostatic, non ferrous shielding to the upper and lower plates of the upper coil form. This shielding helps keep high frequency harmonics from power lines and modern electronic devices out of the upper coil.

Claim 5 has been voluntarily amended to specify an air gap between said upper coil

form permanent magnets and said lower coil form core to reduce the amount of string signal flux that gets into said lower coil form.

Claims 5, 12 and 13 have been rejected under 35 USC 103(a) as being unpatentable over Blucher et al. Claim 5 calls for alnico magnets. Claim 12 calls for ferrous material for the flux transfer plates. Claim 12 has been rewritten to independent form to recite the limitations of its original parent claim, but those limitations have been amended to recite a smaller lower coil winding and flux transfer plates that guide noise flux along a continuous path with no air gaps into the core of the lower coil. Claim 13 has been rewritten to independent form to add the limitations of the parent claim but eliminating the phrase which was rejected as indefinite and adding limitations along the same lines as the amendments to claim 12.

Given the fact that claim 5 depends from claim 3 which has been amended to recite several significant differences over Blucher, the equivalence of alnico magnets to other materials is now moot for purposes of obviousness. Given that claim 12 has been amended to recite the smaller lower coil and the flux transfer plates guiding noise flux into the core of the lower coil, the equivalence of the materials for the flux transfer plates is moot in terms of obviousness. Given that claim 13 has been amended to recite the smaller lower coil and the flux transfer plates guiding noise flux into the core of the lower coil, the equivalence of the materials is moot in terms of obviousness.

Claim 10 was rejected as obvious over the combination of Blucher with Kinman (5,668,520). Claim 10 depends from claim 3 which has been amended to recite a lower coil which is smaller than the upper coil, and to specify the flux transfer plates guide the flux into the core of the lower coil winding. Claim 10 itself specifies details about the flux transfer plates.

The Examiner cites Kinman for its teaching of a second set of vertical walls in the flux

transfer plates. The Kinman shielding system differs from the claimed shielding system in several key respects.

First, the Kinman shielding system covers the outside of both the upper and lower coils with magnetic shielding. This approach would not work in the claimed invention because it would not allow the use of asymmetrical coil geometry. In the claimed invention, only the ouside of the upper coil is shielded by the flux transfer plates, and then the flux transfer plates transition to go into the core of the smaller lower coil thereby leaving it exposed to the ambient noise flux while shielding the upper coil from the ambient noise flux.

Second, unlike the claimed invention, Kinman does not couple the upper shield directly into the core of the lower coil and therefore he does not enhance the noise and hum level in the lower coil. In Kinman's technology, enhancing the hum and noise signal in the lower coil would not work. Therefore, Kinman teaches away from the claimed invention since one skilled in the art would not perceive a liklihood of success in adapting Kinman to Blucher and trying to enhance the noise and hum level in the lower coil.

The intention of Kinman's shielding system is to "inductively and magnetically decouple (the coils) from one another by the shield" (Col. 2, 43-45)

Kinman's lower coil pole pieces do not all extend fully to the top of the lower coil, so they would not be able to couple the ambient field flux carried by the upper shield into the core of the lower coil. (Col. 2, 65-67)

Kinman's design requires impedance matched coils (Col. 2, 51-52). The claimed invention does not require impedance matched coils and would not function properly if the coils were impedance matched.

It is essential in the Kinman design that both coils be contained within the shields (Col. 3, 4-17; col. 3, 42-45). This teaches away from the claimed invention since in the

claimed invention, it is important to have the upper coil shielded from noise flux but not the lower coil.

Kinman teaches impedance matching is important to his design, and his coils have between 1000 and 7000 turns per coil. In the claimed invention, the opposite is true. The upper coil has between 8100 and 8600 turns while the lower coil only has 3100 to 3500 turns so impedance matching does not exist in the claimed invention.

No other manufacturer of guitar pickups has devised the unique combination of coil size and shielding features which distinguish the claimed invention over the prior art. Using only the teachings of the prior art, which the Examiner is required to so to support the prima facie rejections, it would be unlikely that a person skilled in the art would make the claimed invention because of teaching away and technological incompatibility.

Respectfully submitted,

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